

SERIOUS GAMES FOR CARPAL TUNNEL  
SYNDROME (CTS) REHABILITATION  
TREATMENT

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### **SUPERVISOR'S DECLARATION**

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Graphics and Multimedia Technology) with Honors.

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## **STUDENT'S DECLARATION**

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at University Malaysia Pahang or any other institutions.

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REHABILITATION TREATMENT

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Thesis submitted in fulfillment of the requirements  
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## ABSTRAK

Carpal tunnel syndrome (CTS) adalah keadaan perubatan kerana mampatan saraf median ketika bergerak melalui pergelangan tangan di terowong carpal. Terowong carpal adalah laluan sempit di pergelangan tangan, yang terbuka ke tangan. Ia dikelilingi oleh tulang pergelangan tangan di bawah dan ligamen carpal melintang di bahagian atas. Saraf median bergerak melalui terowong carpal dan memberi perasaan kepada ibu jari, telunjuk, jari tengah dan separuh jari cincin. Banyak urat atau otot juga melalui terowong karpal ini dan jika ada pembengkakan berlaku, saraf median yang besar dapat mampatan dengan mudah, menyebabkan CTS. Pemulihan untuk CTS mempunyai dua iaitu fizikal terapi dan pembedahan. Permainan ini untuk rawatan pemulihan sindrom carpal tunnel (CTS) untuk membantu dan memberi manfaat kepada pesakit dengan Sindrom Tunnel Carpal. Permainan ini dibangunkan dengan pergerakan fisioterapi berikut untuk permainan dan semua elemen dan keperluan dalam permainan ini dari pemulihan perubatan supaya ia lebih berkesan kepada pengguna. Permainan ini membuat pesakit berasa seronok untuk melakukan senaman. Metodologi ADDIE dipilih kerana ia menyediakan struktur yang sistematik semasa permainan ini sedang berkembang. Model ini mempunyai lima fasa untuk membangunkan iaitu analisis, reka bentuk, pembangunan, dan sistem pelaksanaan dan penilaian. Permainan serius untuk rawatan pemulihan sindrom carpal tunnel (CTS) terdiri daripada dua utama utama termasuk permainan dan mengenai CTS. Permainan untuk pesakit CTS berkembang dengan pergerakan fisioterapi berikut dan ia terdiri daripada dua pergerakan yang merupakan gerakan aktif gerakan dan pergelangan tangan dan setiap pergerakan mempunyai dua peringkat, untuk setiap peringkat mempunyai corak perbezaan permainan untuk pengguna selesai. Di samping itu, mengenai CTS terdiri daripada maklumat mengenai CTS, gejala CTS, rawatan dan latihan untuk rujukan pengguna. Permainan ini untuk Rawatan Rehat Pemulihan Carpal Tunnel (CTS) telah diuji oleh pesakit dan Encik Azeri sebagai pemulihan perubatan di Pusat Kesihatan Pelajar, UMP Gambang telah menguji keberkesanan permainan ini kepada pesakit. Ujian ini membantu untuk mencapai matlamat permainan ini. Permainan ini membantu dan memberi manfaat kepada pesakit sindrom carpal tunnel supaya kesakitan dapat dikurangkan dan CTS dihindari. Mengikut ujian itu membantu pesakit melegakan kesakitan mereka dengan bermain permainan CTS dan memberi mereka maklumat lebih lanjut mengenai CTS.

## **ABSTRACT**

Carpal Tunnel Syndrome (CTS) is a medical condition due to median nerve compression when traveling through the carpal tunnel's wrist. The carpal tunnel is a narrow passage in the bracelet that opens in the hand. It is surrounded by the below wrist bones and the transverse carpal ligament above. The middle nerve runs through the carpal tunnel and gives the thumb, forefinger, middle finger and half of the ring finger. Many tendons also pass through this carpal tunnel and the large median nerve can be easily compressed if swelling occurs, causing carpal tunnel syndrome. Physical therapy and surgery are two wishes for rehabilitation for CTS. Serious games for carpal tunnel syndrome (CTS) rehabilitation treatment develop for help and benefits the patient with Carpal Tunnel Syndrome. This game develop by following physiotherapy movement for the game and all the element and requirement in this game from medical rehab so that it more effective to user. This game make patient feel fun to do the exercise. The ADDIE methodology model is chosen because it provides a systematic structure while this game is developing. This model has five phases to develop which are the analysis, design, development, and implementation and evaluation system. Serious games for carpal tunnel syndrome (CTS) rehabilitation treatment consist of two main major including game and about CTS. Game for CTS patient develop by following physiotherapy movement and it consist of two movement which is active range of motion and wrist extension and each movement have two level, for each level have difference pattern of game for user to complete. In addition, about CTS consist of information about CTS, symptoms of CTS, treatment and exercise for user to refer. Serious games for Carpal Tunnel Syndrome (CTS) Rehabilitation Treatment has been test by patients and Mr. Azeri as a medical rehab at Pusat Kesihatan Pelajar, UMP Gambang test the effectiveness this game to the patient. This test helps to achieve this game's goal. This game helps and benefits the carpal tunnel syndrome patient so that pain can be reduced and CTS avoided. According to the testing it help patient to relief their pain by play CTS game and give them more information about CTS.

## **TABLE OF CONTENTS**

**DECLARATION**

**TITLE PAGE**

**ACKNOWLEDGEMENTS** **ii**

**ABSTRAK** **iii**

**ABSTRACT** **iv**

**TABLE OF CONTENTS** **v**

**LIST OF TABLES** **ii**

**LIST OF FIGURES** **ii**

**LIST OF ABBREVIATIONS** **iii**

**CHAPTER 1 INTRODUCTION** **4**

1.1 Introduction 4

1.2 Problem Statement 5

1.3 Objectives 6

1.4 Scope 7

1.5 Thesis Organization 8

**CHAPTER 2 LITRETURE REVIEW** **9**

2.1 Introduction 9

2.2 Carpal Tunnel Syndrome (CTS) 9

1.2.1 Symptoms of Carpal Tunnel Syndrome 10

2.2.2 Therapy and Rehabilitation Treatment for CTS 11



2.3 Serious Game	12
2.4 Review of Existing Systems	14
2.4.1 The Roller Ball	14
2.4.2 Exercise Carpal Tunnel	17
2.4.3 Carpal Tunnel Syndrome	20
2.5 Comparison Between Existing Systems	22
2.5.1 Analysis Comparison Between Existing Systems	22
2.5.1 Advantages and Disadvantages Existing System	24
2.6 Summary	25
 <b>CHAPTER 3 METHODOLOGY</b>	 <b>26</b>
3.1 Introduction	26
3.2 Methodology Used	26
3.2.1 Analysis	28
3.2.2 Design	30
3.2.2.1 Flowchart	31
3.2.2.2 Context Diagram	32
3.2.2.3 Use Case Diagram	32
3.2.2.4 Content Diagram	33
3.2.2.5 Storyboard	34
3.2.3 Development	62
3.2.4 Implementation	62
3.2.5 Evaluation	62
3.3 Hardware and Software Specification	62

3.4 Gantt Chart	64
3.5 Summary	65
<b>CHAPTER 4 RESULT AND DISCUSSION</b>	<b>66</b>
4.1 Introduction	66
4.2 Implementation	66
4.2.1 Environmental Setup	66
4.2.2 Module	69
4.2.3 Home Interface	70
4.2.4 Game Interface	72
4.2.5 About CTS Interface	80
4.3 Strengths and Weakness	84
4.4 Result and Discussion	85
4.4.1 User Acceptance Test	90
4.5 Summary	89
<b>CHAPTER 5</b>	<b>93</b>
5.1 Introduction	93
5.2 Project Constraint	93
5.3 Future Work	94
5.4 Advantages and Disadvantges	94
<b>REFERENCES</b>	<b>96</b>
<b>APPENDIX A</b>	<b>98</b>
<b>APPENDIX B</b>	<b>99</b>

<b>APPENDIX C</b>	<b>100</b>
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<b>APPENDIX D</b>	<b>101</b>
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<b>TABLE</b>	<b>LIST OF TABLES</b>	<b>PAGE</b>
Table 1.1	The Project Problem Statement Carpal Tunnel Syndrome Game	15
Table 2.1	Comparison between CTS Applications	22
Table 2.2	Advantage and Disadvantage Applications	24
Table 3.1	Main Interface CTS Game	34
Table 3.2	Option Interface CTS Game	35
Table 3.3	Type of Movement Game	36
Table 3.4	Level of Active Range of Motion Game	37
Table 3.5	Level Easy Of Active Range of Motion Game	38
Table 3.6	Level Hard of Active Range Motion Game	39
Table 3.7	Level of Wrist Extension Game	40
Table 3.8	Level Easy of Wrist Extension Game	41
Table 3.9	Level Hard of Wrist Extension Game	43
Table 3.10	Option Game	44
Table 3.11	How to Play Game	46
Table 3.12	Symptoms of CTS	47
Table 3.13	Treatment option	48
Table 3.14	Nonsurgical treatment 1	49
Table 3.15	Nonsurgical treatment 2	50
Table 3.16	Surgical treatment 1	51
Table 3.17	Surgical treatment 2	52
Table 3.18	Surgical treatment 3	53
Table 3.19	Surgical treatment 4	54
Table 3.20	Option for CTS exercise	55
Table 3.21	CTS exercise 1	56
Table 3.22	CTS exercise 2	57
Table 3.23	CTS exercise 3	58
Table 3.24	CTS exercise 4	60
Table 3.25	Exit game interface	61
Table 3.26	List of Hardware	63
Table 3.27	List of Software	63
Table 4.1	User Acceptance Test	89
Table 5.1	Advantages and disadvantage	94

<b>FIGURE</b>	<b>LIST OF FIGURES</b>	<b>PAGE</b>
Figure 2.1:	Carpal Tunnel Syndrome Therapy Anatomy	10
Figure 2.2:	Carpal Tunnel Rehabilitation Exercis	12
Figure 2.3:	Rehabilitation Games Gabarello	13
Figure 2.4:	Four Wrist Physiotherapy Exercises (Pachoulakis & Tsilidi, 2016).	14
Figure 2.5:	Control a Ball across a Bridge (Pachoulakis & Tsilidi, 2016).	15
Figure 2.6:	Safety Exercise for Carpal Tunnel Syndrome	16
Figure 2.7:	Quiz and Information about CTS	17
Figure 2.8:	Safety Exercise for Carpal Tunnel Syndrome	18
Figure 2.9:	Quiz and Information about CTS	19
Figure 2.10:	Type of Exercise CTS	20
Figure 2.11:	Video Tutorial for Each Type Exercise CTS	21
Figure 3.1:	ADDIE Model.	26
Figure 3.2:	Work Breakdown Structure ADDIE Model	27
Figure 3.3:	Movement for exercise	29
Figure 3.4:	Flowchart	31
Figure 3.5:	Context Diagram	32
Figure 3.6:	Use Case Diagram	32
Figure 3.7:	Content Diagram	33
Figure 3.8:	Gantt chart 1	64
Figure 3.9:	Gantt chart 2	65
Figure 4.1:	Unity	67
Figure 4.2:	MonoDevelopment	67
Figure 4.3:	Unity Remote 5	68
Figure 4.4:	Module in hierarchy diagram	69
Figure 4.5:	Shows the first interface of CTS serious game	70
Figure 4.6:	Script for acceleration	71
Figure 4.7:	Start function and quit function for CTS game	71
Figure 4.8:	Script for acceleration	72
Figure 4.9:	Game Option	72
Figure 4.10:	Game option	73
Figure 4.11:	Easy game for Active range of motion	74
Figure 4.12:	Hard game for Active range of motion	74
Figure 4.13:	Easy game for Wrist Extension	75

Figure 4.14:	Hard game for Wrist Extension	76
Figure 4.15:	Game countdown timer	77
Figure 4.16:	Function for acceleration android to control the ball	77
Figure 4.17:	Ball settings for size and position	78
Figure 4.18:	Ball settings for rigid body contain mass and angular drag.	78
Figure 4.19:	Ball settings for constraints and Script.	78
Figure 4.20:	Ball settings for time moving	79
Figure 4.21:	Ball script for ball time moving	79
Figure 4.22:	Score interface	80
Figure 4.23:	About CTS option.	80
Figure 4.24:	Basic information about CTS	81
Figure 4.25:	Symptoms CTS	81
Figure 4.26:	Rehabilitation and treatment CTS	82
Figure 4.27:	Exercise option	83
Figure 4.28:	Exercise interface for wrist bend	83
Figure 4.30:	Patient play the game	85
Figure 4.31:	Patient play the game	86
Figure 4.32:	Medical rehab functionality game	86
Figure 4.33:	Medical rehab test the game	87
Figure 4.34:	Question	88

## **LIST OF ABBREVIATIONS**

SBPWM	Simple Boost Pulse Width Modulation
ZSI	Z source inverter

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION**

Carpal Tunnel Syndrome (CTS) is a medical condition due to median nerve compression when traveling through the carpal tunnel's wrist. The carpal tunnel is a narrow passage in the bracelet that opens in the hand. It is surrounded by the below wrist bones and the above carpal ligament. The median nerve crosses the carpal tunnel and gives a feeling to the thumb, forefinger, centre and half of the ring finger. Many tendons also pass through this carpal tunnel and the large median nerve can be easily compressed if any swelling occurs, causing carpal tunnel syndrome.

Using a phone or tablet can cause damage and pain, including tingling and numbness in your hands and wrists. Starting with 500 students, an international study found that 54 percent of intensive users using devices longer than three hours a day showed signs of CTS. CTS is a common disease occurring in 2.7% of the general population. Women are more common than men, and the average age of CTS patients is 40 - 50 years (HealthDay News, 2017).

Physical therapy and surgery are two wishes for rehabilitation for CTS. Physical therapy has resulted in better results in the short term. Those who received treatment had less pain and a better function than those who had surgery.



Therefore, this thesis will focus on how the symptoms of carpal tunnel syndrome and treatment for rehabilitation could help and benefit the patient with CTS.

## 1.2 PROBLEM STATEMENT

There were many mobile games in these days of advanced technology that offer state-of - the-art technology that could promise user satisfaction. Malaysians spend over three hours on their smartphones every day, according to the smartphone user. As regards use, 40 percent of users spent time on social networking and chatting, 36 percent on entertainment and 15 percent on utility apps, it shows that they spend too much on their smartphones (The star online, 2016).

People who spend a lot of time on their smartphones can cause CTS because scrolling, taping and swiping affects their hands, painful wrist and disorder of their hands.

Table 1.1: The Project Problem Statement Carpal Tunnel Syndrome Game

No.	Problem	Description	Effect
1.	Social isolation.	Malaysians spend more than three hours every day on their smartphones.	<ul style="list-style-type: none"> <li>• Painful wrist and hand disorder.</li> </ul>
2.	Constant distraction.	CTS is a condition that causes tingling, numbness and other symptoms in your hand and your arm.	<ul style="list-style-type: none"> <li>• Performance in daily routine.</li> </ul>
3.	Tingling or numbness	Usually the thumb and index, middle or ring fingers are affected	<ul style="list-style-type: none"> <li>• Drop objects</li> <li>• Shake out</li> <li>• Sensation like an electric shock</li> </ul>

### **1.3 OBJECTIVES**

The objective of this study is to develop a game application for patients to practice physical therapy treatment that can often relieve pain and numbness and restore normal use of the hand, wrist and arm without surgery. The objectives of achieving this objective are as follows.

- I. To study the types of Carpal Tunnel Syndrome and rehabilitation therapy.
- II. To design and develop a serious game for help and benefits the patient with Carpal Tunnel Syndrome.
- III. To evaluate serious game effectiveness Carpal Tunnel Syndrome (CTS) Rehabilitation Treatment for Carpal Tunnel Syndrome patient.

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